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ABSTRACT

This document is organized under three knowledge skills standards and two process skills standards which reflect the breadth of environmental education and its goal of environmental literacy. Related benchmarks and indicators suggesting appropriate expectations for learner performance and achievement at specific grade levels (fourth, eighth, and twelfth grades) follow each standard. Each standard in the main body of the document contains a series of benchmarks that describe what students should know and be able to do at a specified time in their schooling. Each benchmark contains a series of indicators that identify what it means for students to meet a benchmark. Indicators are frequently followed by examples illustrating classroom activities for meeting the standards. (ASK)

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Environmental Education Standards for Kansas

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Environmental Education Standards for Kansas Writers

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Introduction

Environmental Education

As a learning process, environmental education is directed at increasing people's knowledge, awareness, and understanding of environmental issues, leading to responsible individual and group actions. The focus of environmental education is to integrate understandings of scientific knowledge and of society's needs through processes that enhance critical thinking, problem solving, and effective decision making.

A base for understanding environmental education is rooted in the framework of goals and objectives produced by international and national conferences during the late 1970s and early 1980s. The Belgrade Charter (1975) was adopted by a United Nations conference and provides a widely accepted goal statement for environmental education:

> "The goal of environmental education is to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones."

A few years later, at the world's first intergovernmental conference on environmental education, the Tbilisi Declaration (1978) was adopted. This declaration built upon the Belgrade Charter and outlined the following five categories of objectives for environmental education:

1) Awareness and sensitivity to the environment and environmental challenges.

2) Knowledge and understanding of the environment and environmental challenges.

3) Attitudes of concern for the environment and a motivation to improve or maintain environmental quality.

4) Skills to identify and help resolve environmental challenges.

5) Participation in activities that lead to the resolution of environmental challenges.

In 1990, the United States Congress approved, and the President signed, the National Environmental Education Act (P.L. 101-619) into law. The Act recognizes the need to have a well-educated and -trained citizenry with the knowledge, skills, and motivation to make informed decisions and take responsible actions to ensure environmental quality. The Act designated the U.S. Environmental Protection Agency (USEPA) to establish an office of environmental education to oversee several major initiatives including a grants program to help states promote and support environmental education.

Background Information

Environmental education (EE) supports the high national and state standards set during the last few years for traditional disciplines such as mathematics, science, social studies, reading and writing.

Recognizing human dependency on natural resources and seeking to preserve, improve, and utilize the Kansas environment for the benefit and enjoyment of all, the educational efforts of the Kansas Association for Conservation and Environmental Education (KACEE) are directed toward the goals of encouraging citizen awareness, stewardship of natural resources, and promoting a full understanding of environmental issues through the educational process. In 1997, KACEE received an EE grant from the USEPA to integrate environmental education into the K-12 educational system in Kansas and its current educational reform efforts (Quality Performance Accreditation). To achieve this goal, three specific objectives are cited:

1) Develop a set of Environmental Education Standards for Kansas (EESK). The national standards currently being developed by the Environmental Education and Training Partnership (EETAP) and the North American Association for Environmental Education (NAAEE) were used as a guide. The EESK, which are not mandated by the Kansas State Board of Education, will be correlated with the core state curricular standards (science, mathematics, language arts, and social studies).

2) Correlate various teacher training materials currently being delivered by KACEE and its partners to the state EE standards and the core state curricular standards. Included in the materials are Project Learning Tree, Project WILD, Project WILD/Aquatic, Project WET, and the Investigating Your Environment series.

3) Disseminate the EE Standards and correlations of EE materials with the core state curricular standards through various workshops (provided for formal educators including pre-service and inservice training, and nonformal educators through pre-professional education and professional development training) conducted by KACEE and its partners, and utilize the broad network represented by KACEE and its partners, including the Kansas State Department of Education and the Kansas State Board of Education, to expand that dissemination.

The Environmental Education Standards for Kansas Document

This document represents the first phase of the USEPA grant project. Using drafts of EETAP and NAAEE national EE standards documents as guidelines, a writing team of Kansas educators, natural resource professionals, and Kansas State Department of Education staff customized the documents to reflect the interests and needs of Kansans.

The EESK document is organized under three knowledge skills standards (Standards 1-3) and two process skills standards (Standards 4-5) which reflect the breadth of environmental education and its goal of environmental literacy. These skills should be incorporated throughout all sections and activities

within the document on a continuing basis. Related benchmarks and indicators suggesting appropriate expectations for learner performance and achievement at specific grade levels (4th, 8th, and 12th grades) follow each standard. Age- and subject-appropriate concepts should also be introduced by K-3, 5-7, and 9-11 grade teachers. For the purpose of clarification, examples illustrating classroom activities for meeting the standards have been included in the EESK document. A glossary is located in the back of the document.

Definitions

The following terms are used for the three levels of the document:

Standard: A curricular standard is a general statement of what a student should know and be able to do in academic subjects.

Benchmarks: A specific statement of what a student should know and be able to do at a specified time in his/her schooling. Benchmarks are used to measure a student's progress towards meeting the standard. Statements outlining the specifics of what a student should know and be able to do are found directly following the benchmark. For the purposes of this document, benchmarks are defined for grades 4, 8, and 12.

Indicators: A statement of the knowledge or skills which a student demonstrates in order to meet the benchmark. Indicators are critical to understanding the standards and benchmarks and are intended to be met by all students. The set of indicators listed under each benchmark is not listed in priority order nor should the list be considered as all-inclusive.

Example: Two types of examples are given in this document. One type provides a specific illustration of how the indicator might be demonstrated by students. A second type provides a sample of what students would need to know related to the indicator. Comments regarding which type of examples are most helpful are welcome.

Yet to Come. . .

The EEKS is the first in a series of documents to be made available to educators. Future documents, to be completed in phases by the end of 2000, will include:

- Correlations of the EEKS to the core state curricular standards.
- Correlations of the EEKS to the activities contained within the environmental education programs Project Learning Tree, Project WET, Project WILD, Project WILD/Aquatic, and Investigating Your Environment.

- Correlations of the activities contained within the above-mentioned environmental education programs to the core state curricular standards.

It is KACEE's intent that these documents will provide educators with the tools necessary to encourage increased usage of environmental education activities in the classroom to meet state and local school performance requirements. The documents will be made available as they are completed, and will be placed on KACEE's web site, <www.kacee.org>.

For more information, please contact Shari L. Wilson, EEKS Project Director, KACEE-Kansas City Office, 51 South 64th Street, Kansas City, KS 66111-2002, phone and fax number (913) 287-6879, or e-mail <wilson-shari@swbell.net>.

Standards by Benchmark

Standard 1, Benchmark 1

Standard 1: **Learners demonstrate an understanding that the earth is a physical system.**

K-4 Benchmark 1: Learners explore the processes that shape the earth.

K-4 Indicators:

By the end of the fourth grade, the students:

1. identify some of the forces that cause erosion and other changes within their own region.
   Example: If they revisit study sites regularly, children will develop an understanding that the earth's surface is constantly changing. They can also simulate some changes, such as erosion, in a small tray of soil or a stream table, and compare their observations with photographs of similar, but larger scale changes.
2. identify, compare, and contrast distinctive landforms, both within their region and other areas of the United States.
   Example: Explore diverse Kansas landforms such as prairies, hills, ponds, lakes, and rivers through field observation, hands-on investigations or simulations, and various media. Compare and contrast Kansas landforms with those found in other areas of the United States.
3. describe the climate of their region.
   Example: Construct a simple weather station, or utilize existing equipment, to gather data for identifying trends and patterns, e.g., record daily weather, graph and compare weather characteristics.
4. describe living and non-living processes that shape the earth.
   Example: Take a nature walk. Record observations such as roots burrowing, and water flowing, and how these processes shape the earth. (Be sure to respect the environment and disturb as little as possible.)

5-8 Benchmark 1: Learners examine the processes that shape the earth.

5-8 Indicators:

By the end of the eighth grade, the students:

1. relate physical processes to the relationship of the earth to the sun.
   Example: The sun has an effect on seasonal change.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 1, Benchmark 1 continued

2. distinguish among naturally occurring short-term forces, long-term forces, and human-caused influences on environmental processes.
   Example: Examples of these processes include earthquakes (short-term), erosion and deposition (long-term), and habitat change or pollution (human-caused).
3. analyze physical phenomena to show patterns.
   Example: Low rainfall patterns, over time, will result in desert climates.
4. link non-living parts of the environment with living portions of the ecosystem.
   Example: The amount of rainfall will determine which plants may grow.
5. recognize different processes that shape the earth, such as weathering and erosion.
   Example: Take the students on a walk around the school yard or to a river, creek, or stream to identify locations where weathering and erosion are taking place.

9-12 Benchmark 1: Learners analyze the systems that shape the earth.

9-12 Indicators:

By the end of the twelfth grade, the students:

1. describe how the distribution and transfer of heat energy affects climates throughout the earth.
   Example: Heat distribution and transfer via winds, ocean currents, and the cycling of water between the earth and the air creates climatic weather patterns.
2. explain how wind and temperature patterns across land and ocean surfaces affect weather.
   Example: Cool Arctic air plus moist Gulf air brings snow to the Great Plains.
3. describe the major landforms of the earth and the physical processes that form them.
   Example: Mountains (plate tectonics and uplift), hills (erosion), plains (wind and water erosion plus deposition), etc., all help to change the physical appearance of the earth.
4. explain the causes and effects of plate tectonics (earth crust movements).
   Example: Convection currents in the mantle produce earth movements which result in earthquakes and volcanic mountain building. Kansas is on a stable continental plate, therefore we don't have mountains.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 1, Benchmark 1 continued

5. describe how each of the 11 Physiographic Provinces of Kansas was formed, and how they are related to the natural communities of the state. Example: The geology and soils (along with precipitation patterns) of the High Plains, Arkansas River Lowlands, Flint Hills, etc., play a big role in the development of natural communities like the shortgrass prairie, sand prairie, tallgrass prairie, etc. (See Kansas Department of Transportation map and *Natural Kansas* book; also Kansas Geological Survey's web site at <www.kgs.ukans.edu>).

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 1, Benchmark 2

K-4 Benchmark 2: Learners explore basic properties of matter and energy.

K-4 Indicators:

By the end of the fourth grade, the students:

1. explain uses and properties of earth materials (rocks, soils, water, and air).
   Example: Compare soil, rock, and/or water samples from around students' homes. Explain how they are used in their natural setting.
2. compare and contrast fossil samples and look for evidence about the plants and animals that lived long ago.
   Example: Use fossil kits, books, and videos to observe and make inferences about past life.
3. explain that energy keeps things going.
   Example: Explore how batteries are a source of energy necessary to keep toys running, how food is necessary for people to function, how gas is necessary to operate cars, how the sun's energy is necessary for plants to grow, etc.

5-8 Benchmark 2: Learners investigate basic properties of matter and energy.

5-8 Indicators:

By the end of the eighth grade, the students:

1. recognize that the sun provides the energy to power various cycles in nature, e.g., the water cycle, air movements, ocean currents, and life processes.
   Example: Using two liter bottles, have students build models to demonstrate one or more of these cycles.
2. illustrate that energy and matter cannot be created or destroyed, but it can change forms.
   Example: Determine the mass of a tissue before and after burning it in a closed container.

9-12 Benchmark 2: Learners analyze and communicate the basic properties of matter and energy.

9-12 Indicators:

By the end of the twelfth grade, the students:

1. explain how the process of photosynthesis transforms the sun's energy in plants and releases oxygen into the air.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 1, Benchmark 2 continued

Example: Carbon dioxide (from the air) + water (from the soil) + light energy (from the sun) + chlorophyll (light energy trapper)= stored energy (in plants) + oxygen (in the air).

2. explain how the process of respiration releases energy and carbon dioxide for growth and other life processes in plants and animals.
   Example: Stored energy (in plants or animals) + oxygen (from the air) = growth and other life processes (in plants or animals) + carbon dioxide (to the air).
3. illustrate how energy and matter flow in the biosphere.
   Example: Use illustrations of food chains, food webs, and energy pyramids.
4. explain combustion (burning) of fossil fuels and the products of this process, such as energy for mechanical motion and waste products.
   Example: Fossil fuel (oil, gas, or coal) + oxygen (from the air) + heat of reaction = heat (to produce steam that spins a turbine which produces electricity) + carbon dioxide (to the air) + noncombusted carbon (to the air).
5. illustrate how different elements and compounds cycle through ecosystems at different rates.
   Example: Use illustrations of carbon, oxygen, nitrogen, phosphorous, and water cycles.

Standard 2, Benchmark 1

Standard 2: **Learners demonstrate an understanding of the relationships and interactions between organisms and the environment.**

K-4 Benchmark 1: Learners investigate organisms and habitats.

K-4 Indicators:

By the end of the fourth grade, the students:

1. identify similarities and differences among a wide variety of living organisms.
   Example: Compare and contrast two animals (e.g., classroom pets such as a gerbil vs. rat) and two plants.
2. classify or group plants and animals according to structures and basic needs (food, water, shelter, space, air, and sunlight).
   Example: Classify birds by foot type (e.g., webbed, clawed, taloned, etc.).

5-8 Benchmark 1: Learners investigate complex relationships among organisms and habitats.

5-8 Indicators:

By the end of the eighth grade, the students:

1. identify the relationships between living and non-living components in a given habitat, e.g., white-tailed deer must have food, water, and shelter in their habitat.
   Example: Have students pick an animal and identify the living and non-living components of that animal's habitat. Have students "predict" what might happen if one or more of the components is removed from the animal's habitat.
2. indicate how resources are used by many organisms.
   Example: Identify different habitats found in a forest. Take two or more of these habitats and show how living organisms use common components of their habitats, e.g., an animal may live in a tree or use the tree as food.
3. recognize that resources are limited, which results in competition. E.g., carrying capacity, food webs, and food chains.
   Example: Discuss predator/prey relationships and identify or predict what might happen when the predator/prey balance changes.

9-12 Benchmark 1: Learners analyze complex relationships among organisms and habitats.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 2, Benchmark 1 continued

9-12 Indicators:

By the end of the twelfth grade, the students:

1. explain how habitat changes influence the size of plant and animal populations.
   Example: When habitats are damaged or reduced, the essentials for a healthy existence, such as food, cover, reproductive space, etc., are reduced, thus decreasing the population size of living organisms.
2. explain how genetic diversity among individuals within a species increases the chances of survival of the species when environmental changes occur.
   Example: The greater the diversity of the gene pool of a species, the greater the chances that some individuals will be able to adapt to the changes, reproduce, and carry on the species.
3. explain how biodiversity of species in an environment increases the chances of survival of at least a few species.
   Example: If an environment consists of a monoculture, such as wheat, a disease, like wheat rust, can destroy all the wheat. On the other hand, a prairie with 35 species of plants, will be able to survive, even if one or two species are removed by disease.

Standard 2, Benchmark 2

K-4 Benchmark 2: Learners identify characteristics that help organisms live in their environment.

K-4 Indicators:

By the end of the fourth grade, the students:

1. compare and contrast offspring of both plants and animals with their parents.
   Example: Create a class garden where students can track a plant's life cycle from beginning as a seed to becoming a seed producer. Observe animal cycles, e.g., butterflies, mealworms, frogs, etc.
2. identify observable characteristics that help organisms survive.
   Example: Construct a plant box investigation to see how plants respond to changing light sources. Compare beaks of birds using simulated "beaks" to try and pick up various objects.

5-8 Benchmark 2: Learners recognize the relationships between organisms' physical characteristics and behaviors and their ability to adapt to the environment.

5-8 Indicators:

By the end of the eighth grade, the students:

1. link physical features and behaviors of plants and animals to their survival in their environment.
   Example: Identify plant and animal adaptations and describe the role that these adaptations have made to the survival of the species.
2. understand how features can be inherited which may allow an organism to better survive.
   Example: Trace the history of the color change of English moths or find other examples of camouflage for species survival by using magazine pictures and other resource materials.

9-12 Benchmark 2: Learners analyze the relationships between organisms' physical characteristics and behaviors and their ability to adapt to the environment.

Standard 2, Benchmark 2 continued

9-12 Indicators:

By the end of the twelfth grade, the students:

1. explain the relationship of genetic variation and rate of reproduction of a species to its chances of surviving the natural selection process during environmental change.
   Example: Some insect populations, due to various gene mutations, have a great deal of genetic variation in their gene pool. Because of this, and their ability to reproduce rapidly, they can quickly develop immunity to insecticides.
2. explain how natural selection helps species adapt to a newly changed environment.
   Example: Individual organisms with genotypes (gene characteristics) that produce phenotypes (physical characteristics) which help them survive in a new environment, will reproduce, and their progeny will carry on the species.
3. explain how genetic variation within a species, and diversity of species within an environment, helps organisms to adapt to and survive future changes in the environment.
   Example: The greater the diversity among genes and species in an environment, the greater the chance to survive environmental change.

Standard 2, Benchmark 3

K-4 Benchmark 3: Learners explore how organisms depend on one another and their environment.

K-4 Indicator:

By the end of the fourth grade, the students:

1. construct a simple food chain.
   Example: Students construct a simple food chain using string and pictures, e.g., oak tree to acorns to squirrels for food and shelter.

5-8 Benchmark 3: Learners investigate the interdependence of living organisms with each other and with the physical environment.

5-8 Indicators:

By the end of the eighth grade, the students:

1. compare and contrast various relationships among organisms, e.g., organisms interact with each other through communities, predator/prey relationships, symbiosis, mutualism, parasitism, etc.
   Example: Study the relationships between fish and other aquatic organisms in a classroom aquarium or an outdoor learning center.
2. investigate the roles of producers, consumers, scavengers, and decomposers.
   Example: Build a classroom compost bin.
3. trace the flow of energy through food webs.
   Example: Using owl pellets, work backwards to reconstruct possible food webs that the owl's prey may have been part of to survive until eaten by the owl.

9-12 Benchmark 3: Learners analyze the interdependence of living organisms with each other and with the physical environment.

9-12 Indicators:

By the end of the twelfth grade, the students:

1. explain how plants, animals, and all the physical components of ecosystems are connected.
   Example: Use illustrations of food webs, predator-prey relationships, mineral cycles, etc.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 2, Benchmark 3 continued

2. describe how ecosystems remain stable over long periods of time through interdependence, cyclic fluctuations, and equilibrium.
   Example: Use illustrations of biological communities, matter cycling in ecosystems, ecological niches, etc.
3. explain how climate change, introduction of new species, and human impacts cause changes in ecosystems.
   Example: Use illustrations of human impacts on the environment as related to introduction of alien species to ecosystems, and the role of humans in producing climatic changes, such as global warming.
4. describe the steps of succession in various biotic communities in Kansas.
   Example: Bare sand bar to appearance of annual forbs (sunflowers and cockleburs) to appearance of sedges and grasses (switchgrass and purpletop) to appearance of woody shrubs (aquatic leadplant and buttonbush) to establishment of a climax woodland of trees (cottonwoods, willows, ash, maple and elm).
5. describe the factors that cause wildlife population change over time.
   Example: Habitat destruction, habitat improvement, climatic changes, etc.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 3, Benchmark 1

Standard 3: **Learners demonstrate an understanding of the varied roles and interactions between humans and the environment.**

K-4 Benchmark 1: Learners explore the relationships among individuals, groups, cultures, and the environment.

K-4 Indicators:

By the end of the fourth grade, the students:

1. identify various groups to which people can belong.
   Example: Create a Venn diagram that illustrates various groups to which class members belong.
2. identify ways in which groups work to meet personal and group needs.
   Example: Involve students in peer and self evaluation of cooperative learning activities.
3. practice basic interpersonal skills, e.g., listening to others, asking questions, identifying similarities and differences, and resolving conflicts.
   Example: Engage students in active listening during sharing time.
4. give examples of how experiences and issues may be interpreted differently by people with different backgrounds.
   Example: Utilize the classroom environment to explore different perspectives, e.g., how do students feel about having windows open or closed, shades open or closed.

5-8 Benchmark 1: Learners investigate the relationships between individuals, groups, cultures, and the environment.

5-8 Indicators:

By the end of the eighth grade, the students:

1. recognize beliefs and assumptions about the physical and social environments that guide individuals toward decisions.
   Example: Ask students to identify the source of their personal beliefs and assumptions about the physical and social environment, then compare with beliefs and assumptions held by Native Americans and early Kansas settlers.
2. understand that groups holding differing views on environmental issues must still work together.
   Example: Have students take part in a land use simulation activity.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 3, Benchmark 1 continued

3. explain how the environment is used differently by different cultures.
   Example: Investigate the use of a natural resource by several different countries and evaluate the environmental impact resulting from each country's use of that resource.
4. recognize that limited resources can cause conflict among groups.
   Example: Investigate Western water rights issues.
5. predict how human-caused changes will affect future environments.
   Example: Study river channelization and the resulting environmental impact.

9-12 Benchmark 1: Learners analyze the relationships between individuals, groups, cultures, and the environment.

9-12 Indicators:

By the end of the twelfth grade, the students:

1. explain how family, religion, gender, socioeconomic status, and other factors influence the values and perceptions individuals have about the environment.
   Example: Parents' outlook on recycling will influence their children's willingness to recycle consumer goods, e.g., plastic bottles, aluminum cans, etc.
2. describe how the actions of businesses, community groups, and other societal organizations may bring about unintended impacts to the environment.
   Example: The development of a shopping center in the city.
3. explain how groups concerned about the environment meet the needs of group members, accomplish group goals, and influence society as a whole.
   Example: National and local organizations provide outlets for individuals to enjoy the natural environment, as well as an opportunity to voice concerns about the environment.
4. explain how cultural change influences perceptions of the environment.
   Example: Diversified cultures have diverse outlooks on the value of the environment.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 3, Benchmark 2

K-4 Benchmark 2: Learners explore the relationships between rules and the learners' environment.

K-4 Indicator:

By the end of the fourth grade, the students:

1. give examples of rules at home, in the neighborhood, and at school as they relate to the environment.
   Example: discuss the reasons for various rules at school and at the park, zoo, or nature center (e.g., staying on paths, no drinking straws at the zoo because they may harm the animals, etc.).

5-8 Benchmark 2: Learners explore the relationships among laws, politics, economics, and the environment.

5-8 Indicators:

By the end of the eighth grade, the students:

1. identify local and state environmental issues.
   Example: Use current event topics from local news to identify current environmental issues.
2. describe ways that decisions about the environment are affected by economics and politics.
   Example: Investigate the economics and politics involved in planning a new landfill.

9-12 Benchmark 2: Learners analyze the relationships among laws, politics, economics, and the environment.

9-12 Indicators:

By the end of the twelfth grade, the students:

1. explain scarcity and uneven distribution of resources as motivating factors behind the progress of economic systems.
   Example: Zinc and lead mining in southeast Kansas at the turn of the century brought about economic boom.
2. describe the role of private property rights in shaping decisions about land use in the United States and in Kansas.
   Example: The movement to change railroad rights-of-way in Kansas to public usage as trails.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 3, Benchmark 2 continued

3. explain human rights, economic development, public health, resource allocation, and environmental quality from the perspectives of the individual, the community, the nation, and the world.
   Example: The complexity of disposing of solid waste.
4. describe the short-term and long-term costs and benefits of addressing local, national, and worldwide environmental problems.
   Example: The use of the Ogallala aquifer for irrigation.
5. describe the governmental and non-governmental roles in addressing local, national, and worldwide environmental problems.
   Example: Enactment of the Endangered Species Act.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 3, Benchmark 3

K-4 Benchmark 3: Learners explore the relationships among resources, technology, and the environment.

K-4 Indicators:

By the end of the fourth grade, the students:

1. examine the relationships between their needs and wants and the resulting impact on the environment.
   Example: Discuss with students the items they wish to take with them on a field trip. Identify which of those items are wants or needs. Evaluate the impact of those items on the environment.
2. observe and describe the natural and cultural characteristics of their community or region.
   Example: Visit historical sites or museums, and compare and contrast the natural and cultural characteristics of the past with the present.
3. identify natural resources used to develop a variety of products.
   Example: Ask students to collect products derived from trees, such as wood, paper, and rubber erasers.
4. collect and reuse or recycle products derived from natural resources.
   Example: Make paper or pinecone bird feeders.
5. identify resources from the environment which meet the needs and wants of a population.
   Example: Explore the uses of water at home and classify each use according to needs and wants.
6. identify ways in which technology affects other people as it relates to the environment.
   Example: Identify technology uses in the local environment and analyze their effects, both positive and negative, e.g., gas lawnmower vs. push lawnmower.

5-8 Benchmark 3: Learners investigate the relationships among resources, technology, and the environment.

5-8 Indicators:

By the end of the eighth grade, the students:

1. explain why international trade is common, and why worldwide resources are uneven.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 3, Benchmark 3 continued

Example: Have students choose a product that they use (such as roller blades), determine what natural resources were used to make the product, and trace the possible source of that resource, e.g., oil from the Middle East might have been used to produce the plastic in the roller blades.

2. classify natural resources as renewable, nonrenewable, or perpetual, and identify the impact of the future availability of natural resources in these categories.
   Example: Conduct a resource use simulation where tokens represent natural resources from each category. Students take the number of tokens needed (for each natural resource) for the role they play.
3. examine how Kansas natural resources are obtained, used, reused, recycled, or discarded.
   Example: Design graphs that illustrate Kansas natural resources and their uses.
4. illustrate historical technological advances that have changed the way people interact with the environment.
   Example: Investigate the environmental impact of the changes in transportation used in Kansas from the time of Native Americans through the present.
5. analyze the costs, risks, and benefits of technology for solving environmental problems.
   Example: Complete a risk assessment of a piece or system of technology presently used in Kansas such as landfilling, nuclear energy, irrigation, or water treatment.

9-12 Benchmark 3: Learners investigate and analyze the relationships among resources, technology, and the environment.

9-12 Indicators:

By the end of the twelfth grade, the students:

1. describe how technology has influenced the quality of life.
   Example: The ready availability of electricity to provide heat, light, etc.
2. describe how technology has altered the natural environment.
   Example: The mining of coal to provide energy for electrical power plants.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 3, Benchmark 3 continued

3. describe how agriculture, mining, manufacturing, energy production, highway construction, and other economic development activities have benefited Kansas.
   Example: The easy access provided by highways has benefited consumers by bringing goods to their communities.
4. describe how agriculture, mining, manufacturing, energy production, highway construction, and other economic development activities have altered the natural environment in Kansas.
   Example: The mining and manufacture of materials for highway construction.
5. identify ways in which various resources can be reused and recycled.
   Example: The conversion of plastic bottles into construction materials.

Standard 3, Benchmark 4

K-4 Benchmark 4: Learners identify environmental issues.

K-4 Indicators:

By the end of the fourth grade, the students:

1. describe ways in which environmental factors help or hinder humans in their community (tornadoes, floods, drought, erosion, hail, wind storms, fire, etc.).
   Example: Following one of these events in the community, use a field experience to observe the effects, both positive and negative.
2. describe environmental changes, natural and cultural.
   Example: Use historical society resources and library media to construct models comparing past and present features of the community.

5-8 Benchmark 4: Learners identify and analyze environmental issues from multiple points of view.

5-8 Indicators:

By the end of the eighth grade, the students:

1. recognize different points of view toward environmental issues.
   Example: Identify the stakeholders involved in a specific Kansas environmental issue and investigate their points of view. Come up with suggested solutions that each stakeholder might want. Figure out possible compromises that all stakeholders might be willing to make.
2. analyze local and state environmental issues based on benefits and risks.
   Example: Debate what families should do with leaves in the fall, e.g., burn them, leave them on the ground, send them to the landfill, compost the leaves, or another solution.

9-12 Benchmark 4: Learners identify and evaluate environmental issues from multiple points of view.

9-12 Indicators:

By the end of the twelfth grade, the students:

1. identify the various uses of soil and water in Kansas.
   Example: Watering lawns and irrigating fields.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 3, Benchmark 4 continued

2. identify the risks and benefits that agriculture, petroleum production, manufacturing, energy production, human communities, and other economic development activities can have on soil and water in Kansas.
   Example: Fertilizers used by agriculture and golf courses causing eutrophication of streams.
3. describe the problems that Kansans face in regard to solid and hazardous waste disposal.
   Example: Finding suitable areas for solid waste disposal.
4. describe the problems that Kansans face in regard to urban growth.
   Example: Good farmland is taken over by urban sprawl.
5. identify the reasons that acquisition of private land for public use is an issue in Kansas. List the arguments for all sides of the issue.
   Example: Good farmland is taken over for public use, thus reducing production.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 4, Benchmark 1

Standard 4: **Learners develop the abilities necessary to conduct scientific inquiries.**

K-4 Benchmark 1: Learners demonstrate scientific questioning skills.

K-4 Indicator:

By the end of the fourth grade, the students:

1. express a simple question in a way that can be investigated.
   Example: See the comprehensive example at the end of Standard 4, Benchmark 2.

5-8 Benchmark 1: Learners demonstrate scientific questioning skills.

5-8 Indicator:

By the end of the eighth grade, the students:

1. design testable questions based on environmental observations, inferences, and predictions.
   Example: Develop open-ended problem questions that can be tested using scientific processes.

9-12 Benchmark 1: Learners demonstrate scientific questioning skills.

9-12 Indicator:

By the end of the twelfth grade, the students:

1. identify an environmental topic to be studied using primary and secondary sources of information, and pose a research question or hypothesis, identifying key variables.
   Example: Select a river or stream to investigate for water quality. Have the students go to various sources (libraries, government agencies, the Internet, etc.), collect information (from books, journals, pamphlets, etc.) and write a review of literature (with citations) regarding water quality issues.

Standard 4, Benchmark 2

K-4 Benchmark 2: Learners demonstrate scientific inquiry skills.

K-4 Indicators:

By the end of the fourth grade, the students:

1. design and perform, in groups or individually, investigations or experiments which can be tested.
2. demonstrate different ways of investigating with simple instruments.
3. describe investigations in ways that allow them to be repeated.
4. gather and record data related to an investigation using appropriate data displays.
5. form conclusions based on the data collected.
6. demonstrate a willingness to modify opinions based on evidence.

   Example for all of Standard 4: Identify a problem area, e.g., an eroded area in the school yard. Students ask simple questions and design investigations or experiments to try different things and see what happens, such as planting grass vs. different plant materials, roping the area off, or covering the area with rocks or mulch. Students can work in groups to gather and record data related to their investigations or experiments. Groups draw conclusions based on data gathered. The groups or class revisit the original questions and formulate opinions based on the evidence.

5-8 Benchmark 2: Learners demonstrate scientific inquiry skills.

5-8 Indicators:

By the end of the eighth grade, the students:

1. refine questions; make assertions and predictions; identify and define variables; develop hypotheses; collect, organize and analyze information/data through surveys, interviews, experiments, or other means.
2. select appropriate measurement strategies, which may include models and simulations.
3. collect data through surveys, interviews, experiments, or other means.
4. consider relationships among variables, develop insightful interpretations, and examine evidence for support or non-support of the hypothesis.

   Example: Identify a local environmental issue that can be tested using science process skills. Develop an open-ended problem question and design and conduct an investigation to test the question. E.g., investigate the effects of XYZ sewage treatment plant on ABC Creek. After completing the investigation, evaluate the processes used and the reliability of the results.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 4, Benchmark 2 continued

9-12 Benchmark 2: Learners demonstrate scientific inquiry skills.

9-12 Indicators:

By the end of the twelfth grade, the students:

1. connect questions with appropriate means of inquiry, including scientific investigations, historical inquiry, and social science observation and research.
2. use sampling techniques, e.g., spatial sampling and random sampling.
3. apply observation and measurement skills in field situations, e.g., interview community members about environmental issues.
4. gather information from a variety of sources, e.g., examine historical sites, censuses, tax records, statistical compilations, economic indicators, transcripts of interviews, surveys, aerial photographs, newspapers, and other data banks.
5. perform basic statistical analyses to describe data using quantitative measures, e.g., mean, median, mode, variability, probability, etc.
6. look for and explain inconsistencies, such as faulty or misleading use of statistics, misrepresentation of data that is presented graphically, or biased selection of data to support a claim.
7. use technology to interpret and communicate, e.g., database and mapping software.
8. integrate and summarize information using a variety of media, e.g., written texts, graphic representations, audiovisual materials, maps, computer-generated images, etc.
9. create models and simulations, e.g., project the effects of habitat fragmentation on species diversity, the water quality effects of a new factory, or the economic impacts of proposed water quality rules.
10. differentiate between causes and effects and identify when causality is uncertain.
11. develop new questions to stimulate further inquiry based on experience, e.g., draw on the results of a stream monitoring project in your area to develop questions that guide an investigation into water quality issues in the community.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 4, Benchmark 2 continued

Example: After the students have completed their review of literature of stream quality, have them select four sites on a local stream for purposes of conducting a scientific investigation. Measure the following parameters: physical (width, depth, flow of current), biological (vertebrates and invertebrates), and chemical (dissolved oxygen, nitrates, phosphates). Compare the results to historical records and to state water quality standards. See whether there are any significant differences between sites (using graphs, statistical tests of significance, maps). Compare and contrast how possible changes in chemical parameters may change biological parameters. Students can brainstorm other possible investigations related to their study.

Standard 5, Benchmark 1

Standard 5: **Learners develop the abilities necessary to participate and make informed decisions regarding environmental issues.**

K-4 Benchmark 1: Learners demonstrate the skills necessary to understand and communicate ideas about environmental issues.

K-4 Indicators:

By the end of the fourth grade, the students:

1. identify and express ideas and understandings regarding the environment.
2. demonstrate an awareness of new information and ideas.
   Example: See the comprehensive example at the end of Standard 5, Benchmark 4.

5-8 Benchmark 1: Learners demonstrate the skills necessary to understand and communicate ideas about environmental issues.

5-8 Indicators:

By the end of the eighth grade, the students:

1. identify a variety of beliefs and values toward the environment and acknowledge that others may hold views different from their own.
2. use a variety of methods to express ideas and viewpoints about environmental issues.
3. identify a range of historical or current environmental issues and analyze them by considering consequences and trade-offs.
4. compare strengths and weaknesses of environmental solutions using evidence to support alternative solutions and viewpoints.
   Example: Identify an environmental issue in Kansas. After examining the issue, students state the side of the issue they support and provide evidence to support their opinion. Identify other opinions and provide evidence to support each alternative point of view. Design charts, graphs, and other methods to communicate their personal opinion and the alternative viewpoints. Make a timeline relating to the issue they have chosen and complete a risk assessment for their chosen solution and each alternative solution.

9-12 Benchmark 1: Learners demonstrate the skills necessary to understand and communicate ideas about environmental issues.

Standard 5, Benchmark 1 continued

9-12 Indicators:

By the end of the twelfth grade, the students:

1. identify and clearly articulate environmental issues and their connections with other issues, e.g., disposal of community solid waste.
2. identify different perspectives on environmental issues and approaches to resolving them. Discuss assumptions and goals that underlie each position, e.g., is a local landfill, incineration, or recycling the answer to the community's solid waste problem.
3. discuss the social, political, and economic implications of environmental issues, e.g., trace the root causes of the community's solid waste problem, its disposal, and likely consequences of the various proposed solutions on different areas within the community.
4. project the likely consequences of failure to resolve a specific environmental issue, e.g., sanitation problems.
5. justify their position on an analysis of information from a variety of sources, personal beliefs and values, and clear reasoning, e.g., select one of the positions and justify it.
6. consider viewpoints that differ from their own and information that challenges their position, e.g., participate in a public forum that discusses all points of view.

   Example: Have the students participate in a simulation dealing with their community's disposal of solid waste. Have them identify and analyze their community's present means of disposing of solid waste. Are there other alternatives to consider for the future? Have the students select different roles from the community. Have them select an alternative that best fits their role. Hold a forum in which each alternative is debated. Take a vote to select an alternative.

Standard 5, Benchmark 2

K-4 Benchmark 2: Learners exhibit an understanding of their role, as individuals, in environmental issues.

K-4 Indicators:

By the end of the fourth grade, the students:

1. identify themselves as members of groups.
2. identify their roles and responsibilities in various groups.
   Example: See the comprehensive example at the end of Standard 5, Benchmark 4.

5-8 Benchmark 2: Learners exhibit an understanding of their role, as individuals, in environmental issues.

5-8 Indicators:

By the end of the eighth grade, the students:

1. develop an understanding of how an individual interacts with societal institutions in order to have an impact on environmental concerns.
2. analyze consequences of personal actions, relate these actions to impacts in the future, and compare personal actions with commonly accepted societal views.
   Example: Investigate the environmental impact of one or more of the students' personal actions, e.g., riding or not riding the bus to school or the length of time it takes them to shower. Compare their actions to commonly accepted societal views on the same action. Analyze how their personal action may impact the future. Consider communicating their findings to community institutions such as neighborhood organizations, local governmental institutions, or the local newspaper.

9-12 Benchmark 2: Learners exhibit an understanding of their role, as individuals, in environmental issues.

9-12 Indicators:

By the end of the twelfth grade, the students:

1. evaluate whether personal involvement is warranted. Consider factors such as personal values, skills, resources, and commitment.
2. describe and suggest ways individuals can work to change how institutions within society function.
3. demonstrate a willingness to work toward the resolution of environmental issues.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 5, Benchmark 2 continued

4. develop a "lessons learned" document or presentation to demonstrate comprehension of an environmental issue.
   Example: Use the same simulation format as Standard 5, Benchmark 1, with community water use as the topic.

Standard 5, Benchmark 3

K-4 Benchmark 3: Learners explore the role of democracy in environmental issues.

K-4 Indicators:

By the end of the fourth grade, the students:

1. practice the basic tenets of democracy, such as the rights and responsibilities of citizens as they relate to their school environment, e.g., right to learn in a safe environment, respect for property of others, etc.
2. discuss rights and responsibilities of a citizen as they relate to the school community.
3. analyze how individual and group actions influence the environment.
4. describe traits that enable people to function collectively as responsible citizens.
5. describe ways in which individual behaviors affect change in the environment.
6. identify some of their own personal responsibilities.
   Example: See the comprehensive example at the end of Standard 5, Benchmark 4.

5-8 Benchmark 3: Learners investigate the role of democracy and other forms of government in environmental issues.

5-8 Indicators:

By the end of the eighth grade, the students:

1. investigate the importance of personal rights and civic responsibilities with regard to environmental stewardship.
2. recognize the roles that individuals, organizations, businesses, and governments play in being environmentally responsible.
   Example: Attend a city council meeting or public forum on an environmental issue, after which the students identify all sides of the issue and prepare a risk assessment for the side they feel most matches their own personal view.

9-12 Benchmark 3: Learners analyze the role of democracy and other forms of government in environmental issues.

Standard 5, Benchmark 3 continued

9-12 Indicators:

By the end of the twelfth grade, the students:

1. identify shared political values and principles that unite U.S. citizens, and analyze conflicting views about their interpretation and application.
2. explain the influence of citizen action and public opinion on particular policy decisions that affect the environment.
3. describe the impact of citizen participation on public concerns and values such as environmental quality and quality of life.
4. evaluate the extent to which individual and group action creates change, meets individual needs, and promotes the common good.
   Example: Using the same simulation format as in Standard 5, Benchmark 1, have the students examine conflicting views regarding the protection of the general welfare and private property rights in a specific land-use decision where a lawsuit has been filed alleging a "taking" of private property rights by the government.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 5, Benchmark 4

K-4 Benchmark 4: Learners demonstrate the skills necessary to take action on environmental issues and evaluate results.

K-4 Indicators:

By the end of the fourth grade, the students:

1. identify problems in the environment and brainstorm solutions.
2. participate in solving group-selected problems.
3. conduct group investigations using community resources.
4. identify and describe the effects of their own actions and the actions of others in the past, present, and future on the environment.
5. describe a healthy environment.
6. employ a variety of strategies to effectively communicate the results of their actions, e.g., speaking, writing, drawing, dramatizing, videotaping, etc.
   Example for all of Standard 5: As an extension of the school yard erosion investigation, *Example for all of Standard 4*, groups of students develop proposals for action. This may require further investigation or research and consultation with resources within the community. Proposals might include advantages and disadvantages, cost analysis, further options and/or possible solutions. Students develop methods for communicating the information in their proposals to share with the school community and decision makers. The agreed upon course of action is implemented and evaluated. Modifications are made when necessary.

5-8 Benchmark 4: Learners demonstrate the skills necessary to take action on environmental issues and evaluate results.

5-8 Indicators:

By the end of the eighth grade, the students:

1. assess the situation, evaluate alternative solutions, and work cooperatively to implement an action plan.
2. analyze and evaluate the results of the action plan and make modifications and revisions as appropriate.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 5, Benchmark 4 continued

Example: Identify a current environmental issue involving the community or the state, e.g., chemical run-off from golf courses. Assess current practices, suggest alternative solutions, and provide risk assessments for the current practice and each alternative solution. Develop an action plan and present it to the individuals and groups involved on all sides of the issue. Solicit feedback from these individuals and groups. Analyze and evaluate the feedback and make appropriate modifications and revisions to the action plan.

9-12 Benchmark 4: Learners demonstrate the skills necessary to take action on environmental issues and evaluate results.

9-12 Indicators:

By the end of the twelfth grade, the students:

1. define and clearly articulate environmental issues to be investigated, and identify connections with other issues.
2. using various resources, identify key individuals and groups involved, and investigate and study proposed solutions for the values and perspectives they represent.
3. investigate issues, applying research methods from the natural and social sciences, e.g., survey a community about an environmental issue using a random sample.
4. evaluate proposed solutions on the basis of their impacts on society and the environment, and on their effectiveness in resolving the issue, e.g., use methods such as cost/benefit analysis, ethical analysis, environmental impact analysis, and risk assessment.
5. define and provide examples of community and individual action appropriate for proposed solutions.
6. describe alternative points of view.
7. explain whether action is needed. Account for factors such as the scale of the issue, proposed solutions, and legal, social, economic, and ecological consequences.
8. describe proposed actions. Articulate well-reasoned arguments supporting their views and decisions.
9. develop plans for individual and collective action based on their investigations and acquired knowledge.
10. decide whether the plan should be implemented, modified, or abandoned.
11. implement the action plan.
12. evaluate the results.

Indicators and examples are not listed in priority order nor are they to be considered as all-inclusive.

Standard 5, Benchmark 4 continued

Example: Using the same simulation format as discussed in Standard 5, Benchmark 1, have the students consider a recycling plan for the community.

Benchmark Matrix

Environmental Education Standards for Kansas
Benchmark Matrix---October 1999

STANDARD 1: Learners demonstrate an understanding that the earth is a physical system.

K-4	5-8	9-12
Benchmark 1: Learners explore the processes that shape the earth. **Indicators:** 1. identify some of the forces that cause erosion and other changes within their own region. 2. identify, compare, and contrast distinctive landforms, both within their region and other areas of the United States. 3. describe the climate of their region. 4. describe living and non-living processes that shape the earth.	**Benchmark 1:** Learners examine the processes that shape the earth. **Indicators:** 1. relate physical processes to the relationship of the earth to the sun. 2. distinguish among naturally occurring short-term forces, long-term forces, and human-caused influences on environmental processes. 3. analyze physical phenomena to show patterns. 4. link non-living parts of the environment with living portions of the ecosystem. 5. recognize different processes that shape the earth, such as weathering and erosion.	**Benchmark 1:** Learners analyze the systems that shape the earth. **Indicators:** 1. describe how the distribution and transfer of heat energy affects climates throughout the earth. 2. explain how wind and temperature patterns across land and ocean surfaces affect weather. 3. describe the major landforms of the earth and the physical processes that form them. 4. explain the causes and effects of plate tectonics (earth crust movements). 5. describe how each of the 11 Physiographic Provinces of Kansas was formed, and how they are related to the natural communities of the state.

Environmental Education Standards for Kansas
Benchmark Matrix---October 1999

STANDARD 1: Learners demonstrate an understanding that the earth is a physical system.

K-4	5-8	9-12
Benchmark 2: Learners explore basic properties of matter and energy. **Indicators:** 1. explain uses and properties of earth materials (rocks, soils, water, and air). 2. compare and contrast fossil samples and look for evidence about the plants and animals that lived long ago. 3. explain that energy keeps things going.	**Benchmark 2:** Learners investigate basic properties of matter and energy. **Indicators:** 1. recognize that the sun provides the energy to power various cycles in nature. 2. illustrate that energy and matter cannot be created or destroyed, but it can change forms.	**Benchmark 2:** Learners analyze and communicate the basic properties of matter and energy. **Indicators:** 1. explain how the process of photosynthesis transforms the sun's energy in plants and releases oxygen into the air. 2. explain how the process of respiration releases energy and carbon dioxide for growth and other life processes in plants and animals. 3. illustrate how energy and matter flow in the biosphere. 4. explain combustion (burning) of fossil fuels and the products of this process, such as energy for mechanical motion and waste products. 5. illustrate how different elements and compounds cycle through ecosystems at different rates.

Environmental Education Standards for Kansas
Benchmark Matrix---October 1999

STANDARD 2: **Learners demonstrate an understanding of the relationships and interactions between organisms and the environment.**

K-4	5-8	9-12
Benchmark 1: Learners investigate organisms and habitats. **Indicators:** 1. identify similarities and differences among a wide variety of living organisms. 2. classify or group plants and animals according to structures and basic needs (food, water, shelter, space, air, and sunlight).	**Benchmark 1:** Learners investigate complex relationships among organisms and habitats. **Indicators:** 1. identify the relationships between living and non-living components in a given habitat. 2. indicate how resources are used by many organisms. 3. recognize that resources are limited, which results in competition.	**Benchmark 1:** Learners analyze complex relationships among organisms and habitats. **Indicators:** 1. explain how habitat changes influence the size of plant and animal populations. 2. explain how genetic diversity among individuals within a species increases the chances of survival of the species when environmental changes occur. 3. explain how biodiversity of species in an environment increases the chances of survival of at least a few species.

Environmental Education Standards for Kansas
Benchmark Matrix---October 1999

STANDARD 2: **Learners demonstrate an understanding of the relationships and interactions between organisms and the environment.**

K-4	5-8	9-12
Benchmark 2: Learners identify characteristics that help organisms live in their environment. **Indicators:** 1. compare and contrast offspring of both plants and animals with their parents. 2. identify observable characteristics that help organisms survive.	**Benchmark 2:** Learners recognize the relationships between organisms' physical characteristics and behaviors and their ability to adapt to the environment. **Indicators:** 1. link physical features and behaviors of plants and animals to their survival in their environment. 2. understand how features can be inherited which may allow an organism to better survive.	**Benchmark 2:** Learners analyze the relationships between organisms' physical characteristics and behaviors and their ability to adapt to the environment. **Indicators:** 1. explain the relationship of genetic variation and rate of reproduction of a species to its chances of surviving the natural selection process during environmental change. 2. explain how natural selection helps species adapt to a newly changed environment. 3. explain how genetic variation within a species, and diversity of species within an environment, helps organisms to adapt to and survive future changes in the environment.

Environmental Education Standards for Kansas
Benchmark Matrix---October 1999

STANDARD 2: **Learners demonstrate an understanding of the relationships and interactions between organisms and the environment.**

K-4	5-8	9-12
Benchmark 3: Learners explore how organisms depend on one another and their environment. **Indicator:** 1. construct a simple food chain.	**Benchmark 3:** Learners investigate the interdependence of living organisms with each other and with the physical environment. **Indicators:** 1. compare and contrast various relationships among organisms. 2. investigate the roles of producers, consumers, scavengers, and decomposers. 3. trace the flow of energy through food webs.	**Benchmark 3:** Learners analyze the interdependence of living organisms with each other and with the physical environment. **Indicators:** 1. explain how plants, animals, and all the physical components of ecosystems are connected. 2. describe how ecosystems remain stable over long periods of time through interdependence, cyclic fluctuations, and equilibrium. 3. explain how climate change, introduction of new species, and human impacts cause changes in ecosystems. 4. describe the steps in succession of various biotic communities in Kansas. 5. describe the factors that cause wildlife population change over time.

Environmental Education Standards for Kansas
Benchmark Matrix---October 1999

STANDARD 3: **Learners demonstrate an understanding of the varied roles and interactions between humans and the environment.**

K-4	5-8	9-12
Benchmark 1: Learners explore the relationships among individuals, groups, cultures, and the environment. **Indicators:** 1. identify various groups to which people can belong. 2. identify ways in which groups work to meet personal and group needs. 3. practice basic interpersonal skills, e.g., listening to others, asking questions, identifying similarities and differences, and resolving conflicts. 4. give examples of how experiences and issues may be interpreted differently by people with different backgrounds.	**Benchmark 1:** Learners investigate the relationships between individuals, groups, cultures, and the environment. **Indicators:** 1. recognize beliefs and assumptions about the physical and social environments that guide individuals toward decisions. 2. understand that groups holding differing views on environmental issues must still work together. 3. explain how the environment is used differently by different cultures. 4. recognize that limited resources can cause conflict among groups. 5. predict how human-caused changes will affect future environments.	**Benchmark 1:** Learners analyze the relationships between individuals, groups, cultures, and the environment. **Indicators:** 1. explain how family, religion, gender, socioeconomic status, and other factors influence the values and perceptions individuals have about the environment. 2. describe how the actions of businesses, community groups, and other societal organizations may bring about unintended impacts to the environment. 3. explain how groups concerned about the environment meet the needs of group members, accomplish group goals, and influence society as a whole. 4. explain how cultural change influences perceptions of the environment.

Environmental Education Standards for Kansas
Benchmark Matrix---October 1999

STANDARD 3: **Learners demonstrate an understanding of the varied roles and interactions between humans and the environment.**

K-4	5-8	9-12
Benchmark 2: Learners explore the relationships between rules and the learners' environment. **Indicator:** 1. give examples of rules at home, in the neighborhood, and at school as they relate to the environment.	**Benchmark 2:** Learners explore the relationships among laws, politics, economics, and the environment. **Indicators:** 1. identify local and state environmental issues. 2. describe ways that decisions about the environment are affected by economics and politics.	**Benchmark 2:** Learners analyze the relationships among laws, politics, economics, and the environment. **Indicators:** 1. explain scarcity and uneven distribution of resources as motivating factors behind the progress of economic systems. 2. describe the role of private property rights in shaping decisions about land use in the United States and in Kansas. 3. explain human rights, economic development, public health, resource allocation, and environmental quality from the perspectives of the individual, the community, the nation, and the world. 4. describe the short-term and long-term costs and benefits of addressing local, national, and worldwide environmental problems. 5. describe the governmental and non-governmental roles in addressing local, national, and worldwide environmental problems.

Environmental Education Standards for Kansas
Benchmark Matrix---October 1999

STANDARD 3: **Learners demonstrate an understanding of the varied roles and interactions between humans and the environment.**

K-4	5-8	9-12
Benchmark 3: Learners explore the relationships among resources, technology, and the environment. **Indicators:** 1. examine the relationships between their needs and wants and the resulting impact on the environment. 2. observe and describe the natural and cultural characteristics of their community or region. 3. identify natural resources used to develop a variety of products. 4. collect and reuse or recycle products derived from natural resources. 5. identify resources from the environment which meet the needs and wants of a population. 6. identify ways in which technology affects other people as it relates to the environment.	**Benchmark 3:** Learners investigate the relationships among resources, technology, and the environment. **Indicators:** 1. explain why international trade is common, and why worldwide resources are uneven. 2. classify natural resources as renewable, nonrenewable, or perpetual, and identify the impact of the future availability of natural resources in these categories. 3. examine how Kansas natural resources are obtained, used, reused, recycled, or discarded. 4. illustrate historical technological advances that have changed the way people interact with the environment. 5. analyze the costs, risks, and benefits of technology for solving environmental problems.	**Benchmark 3:** Learners investigate and analyze the relationships among resources, technology, and the environment. **Indicators:** 1. describe how technology has influenced the quality of life. 2. describe how technology has altered the natural environment. 3. describe how agriculture, mining, manufacturing, energy production, highway construction, and other economic development activities have benefited Kansas. 4. describe how agriculture, mining, manufacturing, energy production, highway construction, and other economic development activities have altered the natural environment in Kansas. 5. identify ways in which various resources can be reused and recycled.

Environmental Education Standards for Kansas
Benchmark Matrix---October 1999

STANDARD 3: **Learners demonstrate an understanding of the varied roles and interactions between humans and the environment.**

K-4	5-8	9-12
Benchmark 4: Learners identify environmental issues. **Indicators:** 1. describe ways in which environmental factors help or hinder humans in their community (tornadoes, floods, drought, erosion, hail, wind storms, fire, etc.). 2. describe environmental changes, natural and cultural.	**Benchmark 4:** Learners identify and analyze environmental issues from multiple points of view. **Indicators:** 1. recognize different points of view toward environmental issues. 2. analyze local and state environmental issues based on benefits and risks.	**Benchmark 4:** Learners identify and evaluate environmental issues from multiple points of view. **Indicators:** 1. identify the various uses of soil and water in Kansas. 2. identify the risks and benefits that agriculture, petroleum production, manufacturing, energy production, human communities, and other economic development activities can have on soil and water in Kansas. 3. describe the problems that Kansans face in regard to solid and hazardous waste disposal. 4. describe the problems that Kansans face in regard to urban growth. 5. identify the reasons that acquisition of private land for public use is an issue in Kansas. List the arguments for all sides of the issue.

Environmental Education Standards for Kansas
Benchmark Matrix---October 1999

STANDARD 4: **Learners develop the abilities necessary to conduct scientific inquiries.**

K-4	5-8	9-12
Benchmark 1: Learners demonstrate scientific questioning skills. **Indicator:** 1. express a simple question in a way that can be investigated.	**Benchmark 1:** Learners demonstrate scientific questioning skills. **Indicator:** 1. design testable questions based on environmental observations, inferences, and predictions.	**Benchmark 1:** Learners demonstrate scientific questioning skills. **Indicator:** 1. identify an environmental topic to be studied using primary and secondary sources of information, and pose a research question or hypothesis, identifying key variables.

Environmental Education Standards for Kansas
Benchmark Matrix---October 1999

STANDARD 4: Learners develop the abilities necessary to conduct scientific inquiries.

K-4	5-8	9-12
Benchmark 2: Learners demonstrate scientific inquiry skills. **Indicators:** 1. design and perform, in groups or individually, an experiment which can be tested. 2. demonstrate different ways of investigating with simple instruments. 3. describe investigations in ways that allow them to be repeated. 4. gather and record data related to an investigation using appropriate data displays. 5. form conclusions based on the data collected. 6. demonstrate a willingness to modify opinions based on evidence.	**Benchmark 2:** Learners demonstrate scientific inquiry skills. **Indicators:** 1. refine questions; make assertions and predictions; identify and define variables; develop hypotheses; collect, organize and analyze information/data through surveys, interviews, experiments, or other means. 2. select appropriate measurement strategies, which may include models and simulations. 3. collect data through surveys, interviews, experiments, or other means. 4. consider relationships among variables, develop insightful interpretations, and examine evidence for support or non-support of the hypothesis.	**Benchmark 2:** Learners demonstrate scientific inquiry skills. **Indicators:** 1. connect questions with appropriate means of inquiry, including scientific investigations, historical inquiry, and social science observation and research. 2. use sampling techniques. 3. apply observation and measurement skills in field situations. 4. gather information from a variety of sources. 5. perform basic statistical analyses to describe data using quantitative measures. 6. look for and explain inconsistencies, such as faulty or misleading use of statistics, misrepresentation of data that is presented graphically, or biased selection of data to support a claim. 7. use technology to interpret and communicate. 8. integrate and summarize information using a variety of media. 9. create models and simulations. 10. differentiate between causes and effects and identify when causality is uncertain. 11. develop new questions to stimulate further inquiry based on experience.

Environmental Education Standards for Kansas
Benchmark Matrix---October 1999

STANDARD 5: Learners develop the abilities necessary to participate and make informed decisions regarding environmental issues.

K-4	5-8	9-12
Benchmark 1: Learners demonstrate the skills necessary to understand and communicate ideas about environmental issues. **Indicators:** 1. identify and express ideas and understandings regarding the environment. 2. demonstrate an awareness of new information and ideas.	**Benchmark 1:** Learners demonstrate the skills necessary to understand and communicate ideas about environmental issues. **Indicators:** 1. identify a variety of beliefs and values toward the environment and acknowledge that others may hold views different from their own. 2. use a variety of methods to express ideas and viewpoints about environmental issues. 3. identify a range of historical or current environmental issues and analyze them by considering consequences and trade-offs. 4. compare strengths and weaknesses of environmental solutions using evidence to support alternative solutions and viewpoints.	**Benchmark 1:** Learners demonstrate the skills necessary to understand and communicate ideas about environmental issues. **Indicators:** 1. identify and clearly articulate environmental issues and their connections with other issues. 2. identify different perspectives on environmental issues and approaches to resolving them. Discuss assumptions and goals that underlie each position. 3. discuss the social, political, and economic implications of environmental issues. 4. project the likely consequences of failure to resolve a specific environmental issue. 5. justify their position on an analysis of information from a variety of sources, personal beliefs and values, and clear reasoning. 6. consider viewpoints that differ from their own and information that challenges their position.

Environmental Education Standards for Kansas
Benchmark Matrix---October 1999

STANDARD 5: **Learners develop the abilities necessary to participate and make informed decisions regarding environmental issues.**

K-4	5-8	9-12
Benchmark 2: Learners exhibit an understanding of their role, as individuals, in environmental issues. **Indicators:** 1. identify themselves as members of groups. 2. identify their roles and responsibilities in various groups.	**Benchmark 2:** Learners exhibit an understanding of their role, as individuals, in environmental issues. **Indicators:** 1. develop an understanding of how an individual interacts with societal institutions in order to have an impact on environmental concerns. 2. analyze consequences of personal actions, relate these actions to impacts in the future, and compare personal actions with commonly accepted societal views.	**Benchmark 2:** Learners exhibit an understanding of their role, as individuals, in environmental issues. **Indicators:** 1. evaluate whether personal involvement is warranted. Consider factors such as personal values, skills, resources, and commitment. 2. describe and suggest ways individuals can work to change how institutions within society function. 3. demonstrate a willingness to work toward the resolution of environmental issues. 4. develop a "lessons learned" document or presentation to demonstrate comprehension of an environmental issue.

Environmental Education Standards for Kansas
Benchmark Matrix---October 1999

STANDARD 5: Learners develop the abilities necessary to participate and make informed decisions regarding environmental issues.

K-4	5-8	9-12
Benchmark 3: Learners explore the role of democracy in environmental issues. **Indicators:** 1. practice the basic tenets of democracy, such as the rights and responsibilities of citizens as they relate to their school environment, e.g., right to learn in a safe environment, respect for property of others, etc. 2. discuss rights and responsibilities of a citizen as they relate to the school community. 3. analyze how individual and group actions influence the environment. 4. describe traits that enable people to function collectively as responsible citizens. 5. describe ways in which individual behaviors affect change in the environment. 6. identify some of their own personal responsibilities.	**Benchmark 3:** Learners investigate the role of democracy and other forms of government in environmental issues. **Indicators:** 1. investigate the importance of personal rights and civic responsibilities with regard to environmental stewardship. 2. recognize the roles that individuals, organizations, businesses, and governments play in being environmentally responsible.	**Benchmark 3:** Learners analyze the role of democracy and other forms of government in environmental issues. **Indicators:** 1. identify shared political values and principles that unite U.S. citizens, and analyze conflicting views about their interpretation and application. 2. explain the influence of citizen action and public opinion on particular policy decisions that affect the environment. 3. describe the impact of citizen participation on public concerns and values such as environmental quality and quality of life. 4. evaluate the extent to which individual and group action creates change, meets individual needs, and promotes the common good.

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Environmental Education Standards for Kansas

Benchmark Matrix---October 1999

STANDARD 5: **Learners develop the abilities necessary to participate and make informed decisions regarding environmental issues.**

K-4	5-8	9-12
Benchmark 4: Learners demonstrate the skills necessary to take action on environmental issues and evaluate results. **Indicators:** 1. identify problems in the environment and brainstorm solutions. 2. participate in solving group-selected problems. 3. conduct group investigations using community resources. 4. identify and describe the effects of their own actions and the actions of others in the past, present, and future on the environment. 5. describe a healthy environment. 6. employ a variety of strategies to effectively communicate the results of their actions, e.g., speaking, writing, drawing, dramatizing, videotaping, etc.	**Benchmark 4:** Learners demonstrate the skills necessary to take action on environmental issues and evaluate results. **Indicators:** 1. assess the situation, evaluate alternative solutions, and work cooperatively to implement an action plan. 2. analyze and evaluate the results of the action plan and make modifications and revisions as appropriate.	**Benchmark 4:** Learners demonstrate the skills necessary to take action on environmental issues and evaluate results. **Indicators:** 1. define and clearly articulate environmental issues to be investigated, and identify connections with other issues. 2. using various resources, identify key individuals and groups involved, and investigate and study proposed solutions for the values and perspectives they represent. 3. investigate issues, applying research methods from the natural and social sciences. 4. evaluate proposed solutions on the basis of their impacts on society and the environment, and on their effectiveness in resolving the issue. 5. define and provide examples of community and individual action appropriate for proposed solutions. 6. describe alternative points of view. 7. explain whether action is needed. Account for factors such as the scale of the issue, proposed solutions, and legal, social, economic, and ecological consequences. 8. describe proposed actions. Articulate well-reasoned arguments supporting their views and decisions. 9. develop plans for individual and collective action based on their investigations and acquired knowledge. 10. decide whether the plan should be implemented, modified, or abandoned. 11. implement the action plan. 12. evaluate the results.

Glossary

GLOSSARY

Definitions of terms contained in the glossary vary from expert to expert. For the purposes of this document, the writing committee has agreed to the following definitions.

adaptation❖: changes in an organism's physiological structure or function or habits that allow it to survive in new surroundings.

aquifer❖: an underground geological formation, or group of formations, containing water. Are sources of groundwater for wells and springs.

atmosphere●: layer of air surrounding the earth's surface.

benchmark♦: a specific statement of what a student should know and/or be able to do at a specified time in his/her schooling. Benchmarks are used to measure a student's progress towards meeting the standard. Statements outlining the specifics of what students should know and/or be able to do are found directly following the benchmark. Benchmarks for the *Environmental Education Standards for Kansas* are defined for grades 4, 8, and 12.

biosphere●: total of all the ecosystems on the planet, along with their interactions; parts of the lithosphere, atmosphere, and hydrosphere in which living organisms can be found.

biotic community❖: a naturally occurring assemblage of plants and animals that live in the same environment and are mutually sustaining and interdependent.

biodiversity●: physical or biological complexity of a system. Usually a measure of different species in an ecosystem (species diversity).

carnivores●: animals that obtain their food by feeding only on other animals.

carrying capacity●: maximum population size of a species that a given ecosystem or area can support indefinitely under a given set of environmental conditions.

chemical cycle●: mechanism by which chemicals such as carbon, oxygen, phosphorous, nitrogen, and water are continuously moved through the biosphere to be renewed again and again for use by living organisms.

Definitions are from the U.S. Environmental Protection Agency❖, the Kansas State Department of Education♦, *Project Learning Tree Secondary Modules* (American Forest Foundation)□, *Dictionary of Geological Terms* (Bates & Jackson)⌘, *The Mosby Medical Encyclopedia, Revised Edition* (Glanze et al.)⊙, *Environmental Assessment* (Jain et al.)○, *A Dictionary of Ecology, Evolution, and Systematics* (Lincoln et al.)■, *Environmental Science* (Miller)●, *Living in the Environment* (Miller)♠, and *Dictionary of Biology* (Steen)✽.

climax community■: a more or less stable biotic community which is in equilibrium with existing environmental conditions and which represents the terminal stage of an ecological succession.

competition●: two or more individual organisms of a single species (intraspecific competition) or two or more individuals of different species (interspecific competition) in the same ecosystem attempting to use the same scarce resources.

compost□: the humus or mulch remaining as a result of the controlled biological decomposition of organic solid waste such as food scraps and yard trimmings. This material can be used as a soil conditioner.

consumers●: organisms that rely on other organisms for their food. Generally divided into primary consumers (herbivores), secondary consumers (carnivores), and microconsumers (decomposers).

convection currents⌘: pattern of mass movement of mantle material in which the central area is uprising and the outer area is downflowing due to heat variations. Thought to be the cause of plate tectonics.

decomposers●: organisms such as bacteria, mushrooms, and fungi that obtain nutrients by breaking down complex matter in the wastes and dead bodies of other organisms into simpler chemicals, most of which are returned to the soil and water for reuse by producers.

ecological/environmental sustainability❖: maintenance of ecosystem components and functions for future generations.

ecological niche●: description of all the physical, chemical, and biological factors that a species needs to survive, stay healthy, and reproduce in an ecosystem. The species' "role" in the environment.

ecosystem●: self-regulating natural community of plants and animals interacting with one another and with their nonliving environment.

endangered species❖: animals, birds, fish, plants, or other living organisms threatened with extinction by human-caused or other natural changes in their environment. Requirements for declaring a species endangered are contained in the Endangered Species Act.

energy■: the capacity to do work; involving thermal energy (heat), radiant energy (light), kinetic energy (motion), or chemical energy.

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energy pyramid●: diagram representing the loss or degradation of useful energy at each step in a food chain. About 80 percent to 90 percent of the energy in each transfer is lost as waste heat, and the resulting shape of the energy levels is pyramidal (shaped like a pyramid).

environment❖: the sum of all external conditions affecting the life, development, and survival of an organism.

environmental assessment❍: a study of the probable changes in the various socioeconomic and biophysical characteristics of the environment which may result from a proposed or impending action.

environmental education❖: a learning process that increases people's knowledge and awareness about the environment and associated challenges; develops the necessary skills and expertise to address these challenges; and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action.

environmental/ecological risk❖: the potential for adverse effects on living organisms associated with pollution of the environment by effluents, emissions, wastes, or accidental chemical releases; energy use; or the depletion of natural resources.

environmental equity/justice❖: equal protection from environmental hazards for individuals, groups, or communities regardless of race, ethnicity, or economic status. This applies to the development, implementation, and enforcement of environmental laws, regulations, and policies, and implies that no population of people should be forced to shoulder a disproportionate share of negative environmental impacts of pollution or environmental hazards due to a lack of political or economic strength.

erosion●: removal of soil by flowing water or wind.

eutrophication●: natural process in which lakes receive inputs of plant nutrients (mostly nitrates and phosphates) as a result of natural erosion and runoff from the surrounding land basin.

extinction●: complete disappearance of an entire species.

food chain●: sequence of transfers of energy in the form of food from organisms in one trophic level to organisms in another trophic level when one organism eats or decomposes another.

formal education❖: education involving the formal school system; includes programs and activities taking place in public and private preschools, elementary schools, middle schools, secondary schools, colleges, and universities.

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fossil⌘: any remains, trace, or imprint of a plant or animal that has been preserved in the earth's crust since some past geologic or prehistoric time.

gene pool●: genetic information possessed by a given reproducing population.

genetic diversity/variation♦: variability in the genetic make-up among individuals within a single species.

genotype●: the genetic constitution of an individual, in contrast to the individual's physical appearance or phenotype.

geological processes⌘: general term referring to surface actions of the earth, such as erosion and subsurface actions, causing mountain building and earthquakes.

geothermal energy●: heat transferred from the earth's intensely hot molten core to underground deposits of dry steam (steam with no water droplets), wet steam (a mixture of steam and water droplets), hot water, or rocks lying relatively close to the surface. Can be used to generate electricity.

global warming❖: an increase in the near surface temperature of the earth. Global warming has occurred in the distant past as the result of natural influences, but the term is most often used to refer to the warming predicted to occur as a result of increased emissions of greenhouse gases.

groundwater: see "aquifer".

habitat●: place or type of place where an organism or community of organisms naturally or normally thrives.

herbivore❖: an animal that feeds on plants.

heredity●: specific traits capable of being transmitted genetically from parents to offspring.

hydrosphere●: region that includes the earth's moisture as liquid waters (oceans, smaller bodies of fresh water, and underground aquifers), frozen water (polar ice caps, floating ice, and frozen upper layer of soil known as permafrost), and small amounts of water vapor in the earth's atmosphere.

hypotheses⌘: conceptions or propositions that are tentatively assumed, and then tested for validity by comparison with observed facts and by experimentation. They are less firmly founded than are theories.

immunity●: the ability to resist infection or overcome the effects of infection.

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indicator♦: a statement of the knowledge or skills which a student demonstrates in order to meet the benchmark.

in-service training✥: training that takes place after teachers are in the classroom.

landfill●: land waste disposal site located to minimize water pollution from runoff and leaching; waste is spread in thin layers, compacted, and covered with a fresh layer of soil each day.

landform⌘: one of the many features that taken together make up the surface of the earth. It includes broad features, such as plain, plateau and mountain, and also minor features, such as hill, valley, slope, canyon, arroyo, and alluvial fan.

laws⌘: in science, formal statements of the invariable and regular manner in which natural phenomena occur under given conditions.

lithosphere●: region of soil and rock consisting of the earth's upper surface or crust and the upper portion of the mantle of partially molten rock beneath this crust.

mantle⌘: the zone of the earth below the crust (upper zone of continental and ocean bottom rock) and above the core (the central part of the earth, probably consisting of iron and nickel alloy).

matter●: anything that has mass and occupies space.

mineral cycle●: mechanism by which chemicals such as carbon, oxygen, phosphorus, nitrogen, and water are continuously moved through the biosphere to be renewed again and again for use by living organisms. Also called the biogeochemical cycle.

monoculture●: cultivation of a single crop (such as wheat or corn) to the exclusion of other crops on a piece of land.

mutation●: inheritable changes in the DNA molecules found in genes as a result of exposure to various environmental factors such as radiation and certain chemicals.

natural resource●: anything obtained from the physical environment to meet human needs.

natural selection●: mechanism for genetic change in which individual organisms in a single population die over time because they cannot tolerate a new stress and are replaced by individuals whose genetic traits allow them to cope with the stress and reproduce successfully to pass these adaptive traits on to their offspring.

niche: see "ecological niche".

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nonformal education❖: education that takes place outside the formal school system; includes programs and activities taking place in museums, nature centers, zoos, aquariums, community clubs, science centers, and other community educational institutions and organizations; also includes television, radio, newspapers, and other media-generated educational programs.

oil reserve♦: the stored oil that a nation has to guard against a political crisis causing shortages of oil imports.

omnivores●: organisms such as pigs, rats, cockroaches, or humans that can use both plants and animals as food sources.

parasitism◆: two organisms living in close association with each other, the one, a parasite, depending upon the other, the host, for some essential food factor.

phenotype●: the physical make-up or appearance of an individual in contrast to its genetic constitution or genotype.

photosynthesis●: the process which occurs in the chloroplasts (chlorophyll-containing bodies) of green plants in which simple sugars are formed from carbon dioxide and water in the presence of light and chlorophyll (green pigment which directs the light trapping and chemical synthesis process).

plate tectonics⌘: a theory in which the lithosphere is divided into a number of plates whose pattern of horizontal movement causes earthquakes and volcanoes at the boundaries of the moving plates.

pre-professional education❖: education for students studying to be park naturalists, zoo educators, and other educators working in nonformal educational settings and institutions.

pre-service training❖: training that takes place at colleges and universities before students are certified to teach.

producers●: organisms that use solar energy (green plants) or chemical energy (some bacteria) to manufacture their own organic substances (food) from inorganic nutrients.

professional development❖: development for nonformal educators working in zoos, museums, nature centers, and other nonformal educational settings and institutions.

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public health⊙: a field of medicine that deals with the general health of the community. Includes such areas as water supply, waste disposal, air pollution, and food safety.

renewable resource□: a naturally occurring raw material or form of energy which has the capacity to replenish itself through ecological cycles and sound management practices. The sun, wind, falling water, and trees are examples of renewable resources.

riparian habitat❖: areas adjacent to rivers and streams with a differing density, diversity, and productivity of plant and animal species relative to nearby uplands.

risk❖: a measure of the probability that damage to life, health, property, and/or the environment will occur as a result of a given hazard.

risk assessment□: process through which one attempts to evaluate and predict the likelihood and extent of harm (in qualitative and quantitative terms) that may result from a health or safety hazard.

scavenger■: any organism that feeds on carrion or organic waste.

solar energy●: direct radiant energy from the sun plus indirect forms of energy, such as wind, falling or flowing water (hydropower), ocean thermal gradients, and biomass, that are produced when solar energy interacts with the earth.

standard♦: a general statement of what a student should know and/or be able to do in academic subjects.

succession■: the gradual and predictable process of progressive community change and replacement, leading towards a stable climax community; the process of continuous colonization and extinction of species populations at a particular site.

theories⌘: concepts or propositions developed from hypotheses, that are supported by experimental or factual evidence, but are not so conclusively proved as to be acceptable as a law, e.g. plate tectonics.

trophic level●: all organisms that consume the same general types of food in a food chain or food web. For example, all producers belong to the first trophic level and all primary consumers belong to the second trophic level in a food chain or a food web.

Venn diagram♦: a graphic organizer displayed as two overlapping circles that show those features either unique or common to two or more concepts.

volcanic⌘: pertaining to the activities, structures, or rock types of a volcano.

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water cycle●: chemical cycle that moves and recycles water in various forms through the biosphere.

weathering: see "erosion".

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